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ABSTRACT

The Environmental Studies Center Outdoor Science program should represent a continuation of the county science curriculum. However, science teachers were insufficiently involved and generally unprepared to conduct effective classroom follow-up activities with students upon returning from outdoor field excursions sponsored by the Environmental Center. Linking field learning and outdoor experiences to practical problem-solving situations was paramount to attaining effective follow-up classroom activities. The project targeted seven sixth-grade science teachers to participate in an Outdoor Science Lab Enhancement Program. The program was developed to fill the gap resulting from the lack of continuity between field experiences and classroom learning. Through a series of mini-workshops and on-site visitations, the seven science teachers showed an increase in class time devoted to outdoor lab follow-up activities within the classrooms. Teacher scores on an Inservice Skills Inventory showed that teacher abilities to conduct follow-up activities improved. Scores obtained from the Teacher Involvement Survey showed that teachers' attitudes toward follow-up activities improved. (Appendices include 14 references, diagnostic information, test results, and materials generated by teachers as a results of participating in the Outdoor Science Lab Enhancement Program.) (Author)

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TRAINING TEACHERS TO DEVELOP AND IMPLEMENT FOLLOW-UP ACTIVITIES TO ENHANCE OUTDOOR SCIENCE ACTIVITIES IN THE MIDDLE SCHOOL

by
JOHN K. WAKEMAN

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A Practicum Proposal
submitted to the faculty of the Center for the Advancement of Education of NOVA University in partial fulfillment of the requirement for the degree of Educational Specialist

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Abstract

Training Teachers to Develop and Implement Follow-Up Activities to Enhance Outdoor Science Activities in the Middle School.
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The Environmental Studies Center Outdoor Science program should represent a continuation of the county science curriculum. Science teachers were insufficiently involved and generally unprepared to conduct effective classroom follow-up activities with students upon returning from outdoor field excursions sponsored by the Environmental Center. Linking field learning and outdoor experiences to practical problem solving situations was paramount to attaining effective follow-up classroom activities.

The project targeted seven sixth-grade science teachers to participate in an Outdoor Science Lab Enhancement Program. The program was developed to fill the gap resulting from the lack of continuity between field experiences and classroom learning.

Through a series of mini-workshops and on-site visitations, the seven science teachers showed an increase in class time devoted to outdoor lab follow-up activities within the classrooms. An Inservice Skills Inventory indicated that teacher scores increased showing that teacher abilities to conduct follow-up activities improved. Scores obtained from the Teacher Involvement Survey showed that teachers attitude towards follow-up activities improved. Appendicies include diagnostic information, test results, and materials generated by teachers as a result of participating in the Outdoor Science Lab Enhancement Program.

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CHAPTER I

Purpose

The practicum site was a small but rapidly growing ocean front community located on the east coast of the United States. The population distribution and income of the community was a study in contrasts. Although per capita income in the county was the highest in the state, the socio-economic profile ranged from affluent families along the coast to families of seasonal farm workers further west. In between there was every imaginable level of privilege and need.

Despite the rapid growth of the community, the county agencies which regulate growth had been to a large degree environmentally responsible. The governing body in the community had passed a number of ordinances which foster preservation of the environment. The result was an environmental oasis in a part of the country where many of the surrounding communities had destroyed much of the natural beauty.

One of the centerpieces of the community was the Environmental Studies Center. The facility was a part of the

county school system and received funding and staff from the school board. The idea for the program came from two middle school teachers. In the early 70's the teachers recognized the need for a grass roots environmental education program. A grant was written resulting in the receipt of federal ESE title III monies to develop, administer, and implement a sequential kindergarten through eighth grade environmental education program. At the termination of the grant in 1976, the county school system assumed total fiscal responsibility for the program.

Since the beginning of the program, the Environmental Studies Center was housed in an old elementary school. The building, an attractive Spanish style building was built by the Work Progress Administration (WPA) in 1938.

Despite the fact that the Environmental Studies Center did not draw full time equivalent (FTE) money from the school district, the program enjoyed broad based support within administrative circles as well as within the community. A main reason for the far reaching support of the Environmental Studies Center was that the program not only

served the public school children, but also the private schools in the county. Adult education programs were also presented in the evenings and on weekends.

The sequential K-8 program touched each child in the county. In the primary grades, the one day hands on program focused on awareness. In the intermediate grades, the focus of the program was on making observations and collecting data. At the middle school level, students participated in a two day program. The students conducted scientific tests, collected data and interpreted the results. Daily instruction consisted of the students being bussed from the home school to the Environmental Studies Center. The center was used as a base of operations for the field work which may have involve trips to the beach, river investigations, vegetation studies, spoil islands, animal habitats and more.

The Center's staff consisted of a director , four teachers, a boat captain, a secretary, and a custodian. The boat captain operated the center's 30 foot floating classroom.

The writer's role as a teacher at the Environmental Studies Center was to act as a leader and guide on the day of the

field trip. The goal of the field trip was to create a situation which would enable the children to make "discoveries" about the environment which would reinforce the lessons that were presented in the regular classrooms.

The ground work for the field trip to the Center was completed by the classroom teacher. Materials consisting of work booklets, video tapes and flash cards were sent to the classroom teacher by the Center staff well in advance of the visit. While at the Center however, the classroom teacher would allow the teaching and the directing of activities to the center staff but was responsible for maintaining proper discipline among the students.

Despite the strong support of the community and schools as well as the enthusiasm of the students, there appeared to be little follow-through of the field experience by the classroom teachers. At that time it became apparent that there was a need to improve the continuity between the Center's activities and the role in the classroom teachers curriculum.

The goal of the Environmental Studies program was to

provide a hands on field experience. In order to conduct an effective field trip, the trip must be preceded by a thorough introduction in which students were prepared for the upcoming lab investigation. Of equal importance were the activities which followed the investigation. Appropriate materials were needed to tie the field experience in to the classroom concepts which had been presented.

The Environmental Studies Center program worked with 950 sixth grade students from throughout the county on a two day field experience. On the first day of the trip, students would spend all of the time on the Center's 30 foot work boat measuring the physical characteristics of the river. Scientific tests were conducted on salinity, oxygen, depth, color, turbidity, bottom type, wind speed and wind direction. Data was collected and recorded at each station. The second day consisted of a trip to one of the river's sources, a canal which feeds water from a large lake through a lock and dam into a lagoonal system where the fresh and salt water combine. The students would return to the Environmental Center for lunch and a tour of the salt water aquarium before

departing for the home schools.

Ideally, the Environmental Center program should be a continuation of the county science curriculum. Preparation for the visit to the Center should tie in to the classroom lessons. To measure mastery of concepts, an up-to-date follow through component should be available to the classroom teacher. A post test which was designed 15 years ago was available for the classroom teacher to use after the field experience.

The evaluative post test (Appendix A) was not being used by the classroom teachers. A poll of the 6th grade teachers (Appendix C) found that 76 per cent of the students were not tested on the material learned in conjunction with the trip to the Environmental Studies Center. It was also discovered that follow-up discussions ranged from nonexistent to as much as 1/2 hour. On the average, 10 minutes or less were spent on follow up of field experience.

The data collected on the boat should become the focus of follow-up in the classroom. If follow-up activities were available, it was expected that at least one full class period

would be spent on data analysis.

There was no current evaluative component to measure the mastery of the concepts. As a result, there was no feedback available to the classroom teacher as well as to the Environmental Center staff. Teachers had overlooked using the data collected on the boat as the basis for a follow-up activity. The data should be used as a learning link between field work and classroom study. As indicated in a teacher poll, (Appendix C) teachers generally felt comfortable preparing students for the trip, but, felt unprepared to lead follow-up activities upon returning to the classrooms.

A Teacher Involvement Survey (Appendix E) was administered to middle school science teachers to ascertain feelings and attitudes towards the current Environmental Studies program. The survey was designed so that choice "A" was a positive response and choice "B" was a negative response. The results showed a 39 per cent positive response and a 69 per cent negative response to the current program (Appendix F). A 50 per cent gain in teacher involvement was expected when teachers felt more

comfortable presenting follow-up activities.

The Outdoor Science Lab Enhancement program was developed to fill the gap resulting from the lack of continuity between field experiences and classroom learning. With sixth grade serving as a pivotal link between self contained and interactive learning, teachers and administrators around the county had targeted the discrepancy as an area of concern.

A broad base of support for the development of a follow-through component for teacher feedback and development of evaluative activities was generated as a result of the importance to the county science curriculum. Support was shown for the development of the science lab enhancement program from county administrators (Appendix D) because of the potential for adoption at other grade levels in the county.

As a result of the deficiencies there was no effective program serving as a link between the field studies offered by the Environmental Studies program and the county science curriculum. The Outdoor Science Lab Enhancement Program served as the bridge between field studies and classroom

learning. The target group (Appendix I) consisted of eight sixth-grade middle school science teachers. Through the development of the Outdoor Science Lab Enhancement Program, achievement of the following objectives were formulated:

After ten weeks of participating in the Outdoor Science Lab Enhancement Program, the target group would increase the current time of 15 minutes or less spent on follow-up activities to a full class period of 45 minutes or an average increase of 150 per cent as measured by a teacher poll.

After ten weeks of participating in the Outdoor Science Lab Enhancement Program, the target group would increase preparedness to conduct follow-up lessons by a average gain of 50 per cent as measured by the pre and post scores of the Teacher In-Service Skills Inventory (Appendix H).

After ten weeks of participating in the Outdoor Science Lab Enhancement Program, the target group would show improved attitudes toward using follow-up activities in the classroom as measured by the pre and post Teacher Involvement Survey (Appendix E).

CHAPTER II

Research and Solution Strategy

Field trips bridge the gap between facts, experimentation and how concepts fit together in the grand scheme of nature (McNaut 1982, Padilla 1980). Historically, field trips were used by Plato and Socrates as a culminating activity in which the students could experience what had been learned . In this country, the concept of traveling outside the classroom to learn first gained acceptance about 100 years ago. In 1895, a paper was published on the use of field trips as educational experiences. At this time a three point format was developed that is still used today: (1.) preparation for the trip, (2.) the trip, (3.) follow-up activities (Krepel 1981). Today the use of field trips is common.

Teachers understand the challenge of connecting learned knowledge (facts) with a sense of real life purpose (application). Lounsburry (1980) concluded that instructional programs in middle schools have a long way to go to make teaching more relevant to the needs and learning styles of students. A major gap in middle school education is

curriculum relevancy.

The depth of this problem is quite severe when considering that middle school students are in a state of rebellion against anything that is not perceived as relevant to a disordered world. In addition, middle school students are impressionable and are forming a list of likes and dislikes that will possibly be carried throughout entire lives (Padilla 1980).

Middle school grades are critical. During middle school years many youngsters begin mentally to sort and arrange likes and dislikes. Students may discover subjects in which a life long interest is maintained. Still others lose enthusiasm for some subjects because of the inability to gain a firm foundation in the principles or because little attempt was made to relate the subject matter to experiences and past observations (Griffin 1976). A report on the state of science education, conducted in California found that children knew what was wrong with science education and indicated that science was boring, irrelevant an in some instances science was virtually non-existent. A survey of

students showed that the longer students are in school the less likely students are to say that they like science and math (Roark 1990). Leary (1990) concluded that students through the 6th grade establish likes and dislikes and that middle school learning should be geared towards natural curiosity.

The "back to basics" movement of the 80's and the advent of computer technology has increased the need for hands on learning in an experimental setting but has decreased the opportunity to include the experiences during the academic year (Baker 1983). Other reasons exist for the low frequency of field trips as academic reinforcement. Many teachers are resistant to including trips in the curriculum. Some of the reasons stated are fear of personal liability, concern that time spent out of the classsroom will take time away from "important required learning" and lack of experience in operating outside the framework of a classroom (Krepel 1981). Baker (1983) and Palermo (1982) believed that increased scrutiny of non basic programs has served to eliminate many quality programs vital to a child's total education. Outdoor and environmental education programs

have become victims of this phenomenon.

Teachers having overcome the fear of planning and conducting a field trip often struggled with the final follow-through phase. Field trip follow-up is the bridge between required school curriculum and real world relevancy. The biggest advantage of a field trip follow-up was the reinforcement brought to concepts taught earlier in class. Shaffer (1987) suggested that upon returning from a field trip, children should be led to follow-up activities that would help integrate and make sense of what had been learned while exploring.

In order to recapture the lost attention of middle school students, the target for such change must be carefully selected. Although the problem to be solved was lack of student interest, the cause of this was the absence of curriculum relevancy. The primary target then, became the classroom teacher and the secondary target, the students. Therefore the proper changes in curriculum relevancy could not be made without first altering the instructional methods used by teachers. To accomplish this, staff development

programs should be selected from the options that promised substantial increases in student learning and aptitude to learn (Joyce 1987).

At the onset of many staff development programs it was often difficult to generate the initial interest needed to encourage teachers to explore a new teaching style. Most teachers used a very narrow range of approaches and would expand that repertoire only when provided substantial and carefully designed training (Sirotnik 1983). The following analogy was presented by Showers (1987) to illustrate the frustration teachers often felt when confronted with an attempt to change current teaching style. "Until you are good at skiing, how could you possibly like it? After you learn the proper moves and become good at it you may very well find that you like it." What motivation would teachers then have to change an instructional style with which a level of comfort had been established? Showers suggested that ultimately, the motivation to engage in staff development and implement the content depends on a desire to increase the power of education.

Joyce (1987) suggested that the best way to convert teachers to new methods of instructing students was involvement in the change process. Teachers would be much more accepting of changes when contributing to the change. Once the changes were agreed upon then a program of practicing and rehearsing the changes with students in an inservice situation would be helpful.

A review of the literature revealed the contention that the flow of knowledge from classroom learning to a field trip and back again to classroom learning was not a smooth cyclic flow for students. Teacher conducted follow-up activities were essential for the maximum carry over and gains of knowledge (Holmay 1987). After reviewing the professional literature, certain critical issues and points appeared important to include in the development of an approach for implementing field work with meaningful follow-up activities. Teachers are generally ill-prepared to lead effective follow-up activities for field trips (Krepel 1981). The need for an inservice to train teachers to develop and lead follow-up activities was expressed in a poll (Appendix C). Teacher

inservice components should develop student activities which included hands on experiences and real life purpose (Lounsbury 1980).

CHAPTER III

Method

In order to implement the Outdoor Science Lab Enhancement Program, dates and times were arranged for meetings and inservices with teachers. A system of monitoring improvements and teacher reaction to the program was also established. Throughout the program an on-going dialog was established with teachers to monitor needs and reactions.

The following ten week plan outlines activities involved in implementing the major objectives of the Outdoor Science Lab Enhancement Program.

Week 1 - An introductory meeting was conducted at the Environmental Center for the target group which was composed of the sixth grade science teachers from the middle schools in the county (Appendix I). Six teachers attended this meeting. At the first meeting, a working relationship with the teachers was developed by discussing the various

backgrounds each possessed as science teachers. It was found that a variety of teaching techniques were used by the teachers attending the meeting. In addition, it was discovered that different constraints were imposed on the teachers at the different schools. As a result of this meeting current problems which teachers faced in making good use of field trips were assessed. Reasons for not making use of field experiences included lack of experience and lack of time due to too much required curriculum. The teachers in the target group shared current strategies for follow-up activities. The results of the Sixth Grade Teacher Poll was discussed (Appendix C). A summary of the Outdoor Science Lab Enhancement Program was presented along with a list of desired outcomes. Participants suggested how the program could be developed to best fit personal teaching styles and current programs. As an assignment, the group was given an In-service Skills Inventory to take home and complete by assessing individual situations (Appendix H).

Week 2 - During the next several days the writer individually

collected the In - Service Skills Inventories from the target group. The survey measured teacher preparedness to effectively use the data collected by the students in a classroom follow-up exercise. The results of the In-Service Skills Inventory were tabulated and an average score computed and used as a base for measuring gains (Appendix H). A follow-up was then conducted with each of the participants individually through a phone interview. Individual concerns for the current follow-up as well as suggested outcomes were discussed. A common concern was the need for proper teacher training on the use of data collected in the field for follow-up activities and the development of an up to date comprehensive test based on the data collected.

Weeks 3 - 5 - Each week a mini in-service was conducted at a different school site. The in-service trained teachers how to integrate the data collected during the field experience into the current curriculum. This type of format was developed to allow teachers to provide students with a practical problem

solving situation. The teachers helped develop questions which could be answered through the manipulation of real data collected by the students in the field. Some of the aspects of the data which were actually manipulated by the students included water salinity, dissolved Oxygen, turbidity, and river bottom type. During the mini in-service a format for work sheets and data sheets was developed which best fit the curriculum needs of the participating teachers.

Weeks 6 - 9 - Over the next four week period students were returning from the field experience at the Environmental Studies Center. Teachers would then introduce the newly developed follow-up activities at the conclusion of each trip. Teacher progress in effectively implementing the activities was monitored through informal weekly meetings with each teacher in the target group. Appropriate changes were made in techniques, presentation, and data analysis work sheets in order to achieve maximum effectiveness within the classroom constraints of the participating teacher.

Week 10 - A final meeting was conducted to assess teacher reaction to the Outdoor Science Lab Enhancement Program. At the meeting, teachers shared success stories as well as failures with the lab follow-up program. Suggestions were made on how to simplify the analysis process without losing the intended effect of manipulating data collected in the field. Suggestions were made on how to further strengthen other parts of the program. A post In-Service Skills Inventory was administered to the group. The Teacher Involvement Survey was later mailed to the participants at home schools to assess attitude change toward conducting follow-up science activities. These surveys were returned by school mail and the results tabulated and compared to the pre -implementation of the same survey (Appendix F).

CHAPTER IV

Results

The Outdoor Science Lab Enhancement Program was developed to increase teacher participation in the use of follow-up activities at the conclusion of a field exercise at the Environmental Studies Center. The instruments used to evaluate the objectives included a teacher poll of class time spent on the program, a pre and post writer developed test of the In-Service Skills Inventory and a pre and post Teacher Involvement Survey.

The first objective was to increase the amount of time that teachers spent on follow-up activities. A poll of the target group of teachers which measured class time spent on follow-up was conducted prior to implementation. At the conclusion of the ten week period of intervention the poll was conducted again. The results of the poll were tabulated and an average was computed. The results were compared to the pre-implementation teacher poll (Appendix J). It was found that prior to implementation the average class time spent on follow-up accounted for ten minutes while post

implementation average class time spent on follow-up accounted for 47 minutes. The increase represents an increase in class time spent on follow-up of 470 per cent. Objective one was achieved.

The second objective was to increase the number of skills teachers used in applying the data collected in the field to practical problem solving situations. An In-Service Skills Inventory was administered to the participating teachers during the first week of intervention and again at the conclusion of the intervention period (Appendix H). The results from the pre and post In-Service Skills Inventory were tabulated and averages computed (Appendix K). The results of the pre In-Service Skills Inventory were compared to those of the post. It was found that prior to implementation teachers used only 12 per cent of the ten identified skills and that at the completion of the program 70 per cent of the same skills were used by the teachers. The increase represents a gain of 584 percent. Objective two was achieved.

The third objective was to improve teacher self confidence in the ability to conduct effective follow-up activities. A

Teacher Involvement Survey was conducted prior to the beginning of ten weeks of intervention (Appendix E). At the conclusion of the ten weeks of intervention the survey was again conducted. The results were tabulated and an average was computed. The results were compared with the pre-implementation survey results (Appendix L). It was found that prior to implementation the positive responses to the Environmental Center's programs were 39 per cent and at the conclusion of the implementation the positive response was 93 per cent. An increase of 239 per cent was measured. Objective three was achieved.

CHAPTER V

Recommendations

The practicum project has been shared with the building administrator at the school site in which the project was implemented. The results discussed with the site administrator included the following.

(1) Middle school science teachers increased the amount of time spent on follow-up activities in the classroom at the conclusion of a field excursion at the Environmental Studies Center.

(2) Middle school science teachers increased the number of skills used in applying the data collected during field activities at the Environmental Studies Center as evidenced by improved scores on the writer-created In-Service Skills Inventory.

(3) Middle school science teachers exhibited improved self confidence in the abilities to conduct effective follow-up activities as shown by increases in positive responses to the writer-created Teacher Involvement Survey.

it has been recommended by the site administrator that the procedures developed in the practicum be used to improve the follow-up of field activities at other grade levels in the county.

The practicum project was shared with district level administrators. It was recommended that the procedures developed in the practicum to improve follow-up of field activities be presented for potential use to other subject areas at a future teacher inservice.

An explanation of the strategies developed in the practicum was presented in a workshop at a state convention of marine science educators. A summary of the activities conducted and materials developed for this program was presented as a packet to participants (Appendix M).

In order to assure teacher support in this project, the writer involved the target group of teachers in each stage of the planning. A teacher survey, group meetings and individual meetings were used to identify the areas to be addressed by the project. Through the individual and cooperative efforts of the target group, the necessary

materials were developed thus increasing teacher interest in the follow-up program (Appendix N).

It is hoped that the project results will contribute to the continued efforts to encourage teachers to adapt instructional styles to include practical problem solving situations through the integration of field trip follow-up activities. The involvement of teachers in the process of identifying areas needing improvement, developing materials to use with students and learning to use resources available to stimulate student problem solving has proven beneficial to students, teachers and the school.

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Appendicies

Appendix A

Current Evaluative Post Test

Sixth Gra

TEST

PHYSICAL INTERRELATIONSHIPS

1. What regularly causes the salinity to INCREASE and DECREASE in the rivers?
   a. tides
   b. depth
   c. wind
   d. mud
2. What type of river bottom is usually found in areas of strong currents?
   a. mud
   b. algae
   c. sand
   d. grass
3. The Red and Black mangroves are found in what type of river bottom?
   a. sand
   b. mud
   c. grass
   d. shells
4. Why is the salinity always changing in the St. Lucie River?
   a. mangrove development
   b. fresh water run-off
   c. fast current
   d. muddy bottom
5. Which can have the MOST affect or influence on the turbidity of the rivers?
   a. temperature
   b. time of day
   c. tides
   d. salinity

Physical Interrelationships (cont'd)

6. Mangrove trees develop in tropic temperatures on shallow banks of the St. Lucie and Indian Rivers. Which of the following physical factors is also necessary for mangroves to grow?
   a. currents
   b. algae
   c. salt water
   d. sand
7. Sandy areas, tropical temperature and salt water are physical factors that influence the development of manatee and turtle grassflats in the Indian River. What other physical factor is also necessary?
   a. shallow water
   b. current
   c. fish
   d. turbid water
8. Seasons, tides and water depth influence the temperature of the rivers. Which of the following physical factors is also an influence on temperature?
   a. algae
   b. sandy bottom
   c. salinity
   d. sun
9. What season of the year is the salinity of the rivers the lowest?
   a. winter
   b. spring
   c. summer
   d. fall
10. What factor causes the St. Lucie River to have a salinity lower than the Indian River?
    a. algae growth
    b. temperature of water
    c. more sunlight
    d. run-off from land and canals

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Appendix A (continued)

ENVIRONMENTAL PROBLEM TEST

11. It was necessary to construct canals and gates from Lake Okeechobee to the ocean because of:

a. irrigation needs of farmers and citrus groves

b. disastrous flooding

c. reduced bird population

d. fish kill in St. Lucie Canal

12. What factor could be a cause of pollution in the Indian and St. Lucie Rivers?

a. tides

b. decrease in pelicans

c. too many grassflats

d. overpopulation

13. What would be a major factor that could destroy mangroves along St. Lucie and Indian River?

a. fresh water flooding

b. high tides

c. tropical climate

d. a build-up of detritus

14. What could destroy the Indian River grassflat nurseries?

a. tides

b. seasons

c. low salinity

d. SE mph wind

15. What is the prime reason for building new power plants in south Florida?

a. temperature is just right

b. plenty of land available

c. gives people jobs

d. an increased population

Environmental Problem Test (cont'd)

16. When the St. Lucie locks are opened for the purpose of lowering the depth of Lake Okeechobee the salinity of our rivers is lowered. What could be the effect on organisms in the river?

a. no effect

b. grow better without so much salt

c. kill many of the organisms

d. cause a high tide

17. The waste coolant water from the nuclear power plant on Hutchinson Island will be dumped into the ocean. One possible effect would be?

a. cool the water

b. change plant and animal life around dumping area

c. no effect

d. cause tide to change

18. Florida has a law that prevents the removal of the Red Mangrove because

a. the government likes mangroves

b. the mangrove is a landbuilder and their removal could cause erosion

c. builders actually prefer mangroves to be part of their landscape

d. mangroves are the state tree

19. Grassflat destruction by dredge and fill in the Indian River Lagoon will:

a. help clean up the river

b. increase the fish population

c. destroy game fishing

d. do no harm

20. You cannot eat oysters and clams in the Indian River in most parts of Martin County because

a. the water is polluted

b. the water is too warm

c. birds destroy most of them

d. the water is too salty

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Appendix A (continued)

VOCABULARY TEST

27. Which two instruments are used to measure salinity?

A. hydrometer - refractometer

B. temperature - thermometer

C. seine - sieve

D. sighting compass - dredge

22. Which is a unit of length?

A. data

B. meter

C. seine

D. gram

23. Which of the following is an organism?

A. fish gill

B. crab

C. seashell

D. rock

24. What trees grow in the brackish waters along the southern coasts?

A. oaks

B. seagrapes

C. cypress

D. mangroves

25. What is an instrument used to gather living material and debris on the river bottom?

A. dredge

B. thermometer

C. water sampler

D. refractometer

Vocabulary Test (cont'd)

26. What is a side view of something called?

A. profile

B. data

C. sighting compass

D. sample

27. What is the information called when you go to the river and take temperatures, bottom samples and salinity?

A. grams

B. data

C. sieves

D. charts

28. What is the cloudiness of the water called?

A. salinity

B. current

C. lagoon

D. turbidity

29. What decides the kind of plants and animals found in the lagoon or St. Lucie River?

A. organisms

B. physical factors

C. shrimp

D. mangroves

30. What is the term for a body of water separated from open water by a sandbar?

for example - the Indian River

A. lake

B. pond

C. lagoon

D. estuary

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Appendix B

6th Grade Science Teacher Poll

1. How many years have you been involved in using the Environmental Studies Center's program as part of your classroom curriculum?

_____

2. How comfortable do you feel preparing your students for their trip to the Environmental Studies Center?

ADEQUATE
VERY COMFORTABLE 1 - 2 - 3 + 4 - 5 - 6 - 7 + 8 - 9 - 10 UNCOMFORTABLE

3. After visiting the Environmental Studies Center, approximately how much class time do you spend on follow up?

__None
__Less than 10 minutes
__10 to 20 minutes
__20 to 30 minutes
__30 to 40 minutes
__more than 1 class period

4. How comfortable do you feel leading your class in in a follow up activity at the conclusion of on Environmental Studies Center trip?

ADEQUATE
VERY COMFORTABLE 1 - 2 - 3 + 4 - 5 - 6 - 7 + 8 - 9 - 10 - UNCOMFORTABLE

5. Do you require your students to take a test covering the material learned at or in preperation for the Environmental Studies Center?

YES_____ NO_____

6. Do you feel that there is a need to develop a series of follow up activities to stimulate class discussion and/or encourage critical thinking

AGREE NOT SURE DISAGREE

1.....2.....3.....4.....5.....6.....7.....8.....9.....10

PLEASE RETURN THIS SURVEY IN THE ENVELOPE PROVIDED.

Appencix C

6th Grade Science Teacher Poll Results

6th GRADE TEACHER SURVEY

OF THE 18, 6TH GRADE TEACHERS CONTACTED, 13 RESPONDED TO THIS SURVEY.

1. How many years have you been involved in using the Environmental Studies Center's program as part of your classroom curriculum?

RANGE IN ANSWERS; 0 - 23 YEARS

AVERAGE RESPONSE : 7 YEARS

2. How comfortable do you feel preparing your students for their trip to the Environmental Studies Center?

ADEQUATE
VERY COMFORTABLE 1 - 2 - 3 + 4 - 5 - 6 - 7 + 8 - 9 - 10 UNCOMFORTABLE

VERY COMFORTABLE: 61%

ADEQUATE : 23%

UNCOMFORTABLE : 16%

3. After visiting the Environmental Studies Center, approximately how much class time do you spend on follow up?

None	*6 RESPONSES*	*46%*
Less than 10 minutes	*4 RESPONSES*	*31%*
10 to 20 minutes	*2 RESPONSES*	*15%*
20 to 30 minutes	*0 RESPONSES*	*0%*
30 to 40 minutes	*1 RESPONSE*	*8%*
more than 1 class period	*0 RESPONSES*	*0%*

Appendix C (continued)

4. How comfortable do you feel leading your class in in a follow up activity at the conclusion of on Environmental Studies Center trip?

ADEQUATE
VERY COMFORTABLE 1 - 2 - 3 + 4 - 5 - 6 - 7 + 8 - 9 - 10 - UNCOMFORTABLE

VERY COMFORTABLE : 8%

ADEQUATE : 31%

UNCOMFORTABLE : 61%

5. Do you require your students to take a test covering the material learned at or in preperation for the Environmental Studies Center?

YES___*3*___ NO____*10*____

76% OF THE TEACHERS DO NOT GIVE A TEST

24% OF THE TEACHERS DO GIVE A TEST

6. Do you feel that there is a need to develop a series of follow up activities to stimulate class discussion and/or encourage critical thinking

AGREE NOT SURE DISAGREE

1.....2.....3.....4.....5.....6.....7.....8.....9.....10

AGREE ..... (CHOICES 1 - 4) ... 85%

NOT SURE.... (CHOICES 5 - 6) ... 15%

DISAGREE... (CHOICES 7 - 10).... 0%

PLEASE RETURN THIS SURVEY IN THE ENVELOPE PROVIDED.

Appendix D

Letters Of Support From Administrators

MARTIN COUNTY SCHOOL DISTRICT

500 E. Ocean Blvd., Stuart, FL 34994 Telephone 407-287-6400

TO: Nova University Staff

FROM: Dr. Terrance E. Horrigan
Assistant Superintendent for Instruction

DATE: December 17, 1990

RE: Nova Praticum Proposal

I concur with John Wakeman, Teacher at Martin County 's Environmental Center, that there needs to be more meaningful articulation between the host school and the sending school in our environmental program.

I recommend this proposal without reservation.

pl

Appendix D (continued)

Martin County Schools
ENVIRONMENTAL STUDIES CENTER
2500 SE Indian River Drive, Jensen Beach, Florida 34957 (407) 334-1262

Dear John;

Your proposal to improve the follow up phase of the Environmental Studies Centers 6th Grade program is an excellent idea. The changes you have proposed will help better prepare teachers to make use of the data which students collect while in the field. In turn, students will benefit through the integration of their field experience into the regular curriculum. If this plan is successful, I would like to see some of these methods applied to our 7th and 8th grade programs.

Sincerely,

Frank Pittman, Director

Appendix E

TEACHER INVOLVEMENT SURVEY

Instructions: Select the best choice for each.

_____ 1. The Environmental Studies Center field experience is a ___?___ program.
a) valid b) invalid

_____ 2. The material covered at the Environmental Studies Center is ___?___ to my curriculum.
a) relevant b) irrelevant

_____ 3. The class time spent on preparing my students for their trip to the Environmental Studies Center trip is ___?___.
a) an important part of the curriculum.
b) time that could be better be spent teaching other important concepts.

_____ 4. The data that is collected by my students as a result of their Environmental Studies Center field experience is ___?___.
a) a valuable teaching tool.
b) of little use to me as a teacher.

Appendix E (continued)

_____ 5. The time spent going over the data collected in the field at the Environmental Studies Center is ___?___

a) a valuable teaching and learning tool.

b) time taken away from teaching more important material.

_____ 6. Which do you feel is a more meaningful way for students to learn science. ___?___

a) The manipulation of self collected data to solve a problem.

b) the memorization of scientific facts.

_____ 7. I think that it would be more beneficial for my students to ___?___ the amount of time used to work with the data collected during the Environmental Studies Center field experience.

a) increase b) decrease

_____8. Over all I feel my students ___?___ from the Environmental Studies Center field experience.

a) benefit b) gain little

Appendix F

Results of pre-administration of the Teacher Involvement Survey

This survey was sent to the nine 6th grade science teachers who will be effected by the implementation of this practicum. Seven of the teachers responded to the survey.

The survey was designed so that choice "A" always represented a positive response and choice "B" always represented the negative response. A break down of the responses is given below.

1.	+ = 5,	71%	/	- = 2,	29%
2.	+ = 2,	29%	/	- = 5,	71%
3.	+ = 3,	43%	/	- = 4,	57%
4.	+ = 0,	0%	/	- = 7,	100%
5.	+ = 1,	14%	/	- = 6,	86%
6.	+ = 5,	71%	/	- = 2,	29%
7.	+ = 2,	29%	/	- = 5,	71%
8.	+ = 4,	57%	/	- = 3,	43%

Appendix F (continued)

The 8 questions on this survey were responded to by 7 teachers, making the total number of responses 56 (7 X 8). Averages for the total number of positive and negative responses were computed and the results are shown below.

- # of + responses = 22, which represents 39%
- # of - responses = 34, which represents 61%

Appendix G

Invitation To Attend Pre-Implementation Meeting

Broward County Schools

ENVIRONMENTAL STUDIES CENTER

[illegible]

TO: All 6th Grade Science Teachers

FROM: John Wakeman

Environmental Center Teacher

RE: Improving the quality of follow-up activities

Dear Colleague;

Earlier this school year, I sent a questionaire to all 6th grade science teachers concerning the effectiveness of the follow up activities you use at the conclusion of your Environmental Center field experience. The general consensus of most every teacher responding to the survey was that there is a need to improve the current follow-up procedure.

On Wednesday, February 20th at 7:00 P.M. I will be conducting a meeting at the Environmental Center at which we can discuss strategies to improve the current follow-up procedures . I have been working on a Practicum through NOVA University concerning the importance of linking field experience to practical problem solving activities. I am anxious to share my findings and to receive input concerning possible changes from you and other science teachers.

Let me know if you will be able to attend this meeting. Please call the Environmental Center at 334-1262 or drop a note to me in the inter-school mail.

Sincerely,

John

Appendix H

In Service Skills Inventory

Instructions: Place a check mark next to the skills that you use in conducting follow-up activities with your classes at the conclusion of the Environmental Studies Center field experience.

_____ 1. Use the compass coordinates measured by your students to plot the location of the work station on a reference map.

_____ 2. Use the wind speed and direction data collected by your groups of students over a period of time to draw long term conclusion about local wind patterns.

_____ 3. Use the salinity data collected by your students to teach the relationship between water density and salinity.

_____ 4. Compare the salinity data from different parts of the rivers to demonstrate the relationship between distance from the ocean and change in salinity.

Appendix H (continued)

_____ 5. Use the dissolved oxygen data collected by your students to teach the oxygen - carbon dioxide cycle.

_____ 6. Correlate the river depth data collected by your students to the depth at the corresponding location on a nautical chart.

_____ 7. Compare the results of the Forel/Ule color scale test to various work stations in order to look for patterns in color.

_____ 8. Use the location map and bottom sample information to look for patterns in the types of river bottom at various locations of the river.

_____ 9. Check the dissolved oxygen reading for a given location when anerobic mud is identified in a bottom sample.

_____10. Use the plankton samples your students collect as subjects for a microscope lab.

Appendix I

Target Group Teacher Profile

Profile Of Target Group

Teacher Number	Number Of Years Of Teaching	Percieved Need For Follow-Up (1-10) 1=agree/10=disagre	Time Now Spent On Follow-Up
1	4	1	0 min.
2	8	5	less than 10 min.
3	13	3	10 - 20 min.
4	3	2	0 min.
5	1	2	10 - 20 min.
6	23	1	less than 10 min.
7	15	3	20 - 40 min.
8	6	5	0 min.

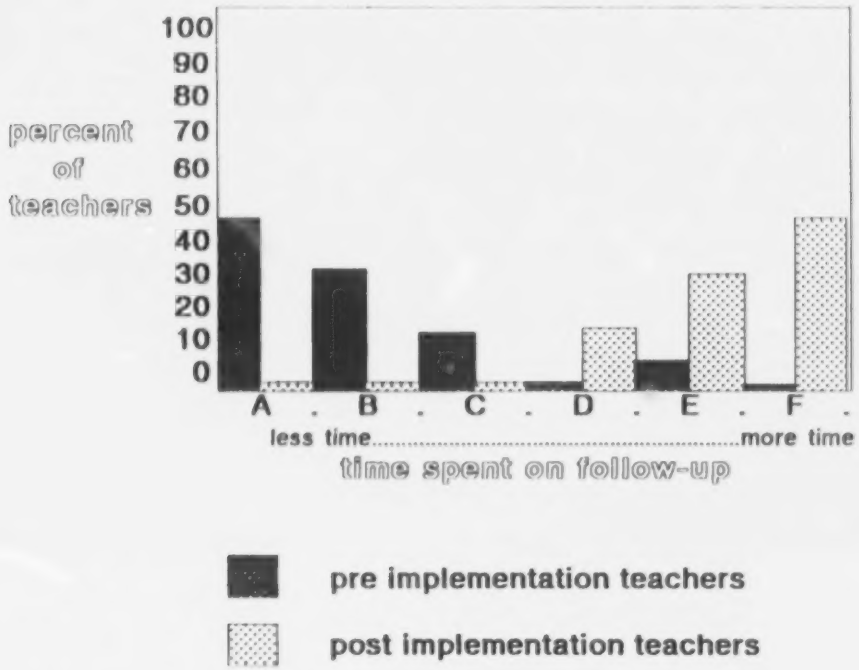
Appendix J

A comparative survey of

CLASS TIME SPENT ON FOLLOW-UP

After visiting the Environmental Studies Center, approximately how much class time do you spend on follow-up?

	PRE IMPLEMENTATION	*POST IMPLEMENTATION*
A - None	46%	0%
B - Less than 10 minutes	31%	0%
C - 10 to 20 minutes	15%	0%
D - 20 to 30 minutes	0%	16%
E - 30 to 40 minutes	8%	33%
F - more than 1 class period	0%	50%



Average class time spent on follow-up prior to implementation....10 min.
Average class time spent on follow-up after implemention..... 47 min.
Total increase in class time spent on follow-up.....470%

Appendix K

A comparison of pre and post implementation response frequency of the

In-Service Skills Inventory

This survey was designed to inventory the skills used by teachers to complete the follow-up phase of the Environmental Studies Center field experience. Teachers indicated which of ten skills were used in their lessons. A break down of the skill usage is presented below.

Pre-Implementation Responses

Based on the responses from the six teachers polled, percentages were generated to indicate usage of skills.

1. teacher usage of skill - 3 - 50%
2. teacher usage of skill - 0 - 0%
3. teacher usage of skill - 0 - 0%
4. teacher usage of skill - 1 - 16%
5. teacher usage of skill - 0 - 0%
6. teacher usage of skill - 0 - 0%
7. teacher usage of skill - 0 - 0%
8. teacher usage of skill - 2 - 33%
9. teacher usage of skill - 0 - 0%
10. teacher usage of skill - 2 - 33%

Overall Response 8 / 60 =12%
Skill Usage

Post Implementation Response

Based on the responses from the six teachers polled, percentagess were generated to indicate usage if skills

1. teacher usage of skill - 6 -100%
2. teacher usage of skill - 2 - 33%
3. teacher usage of skill - 6 -100%
4. teacher usage of skill - 6 -100%
5. teacher usage of skill - 5 - 33%
6. teacher usage of skill - 2 - 33%
7. teacher usage of skill - 6 -100%
8. teacher usage of skill - 6 -100%
9. teacher usage of skill - 1 - 16%
10. teacher usage of skill - 5 - 84%

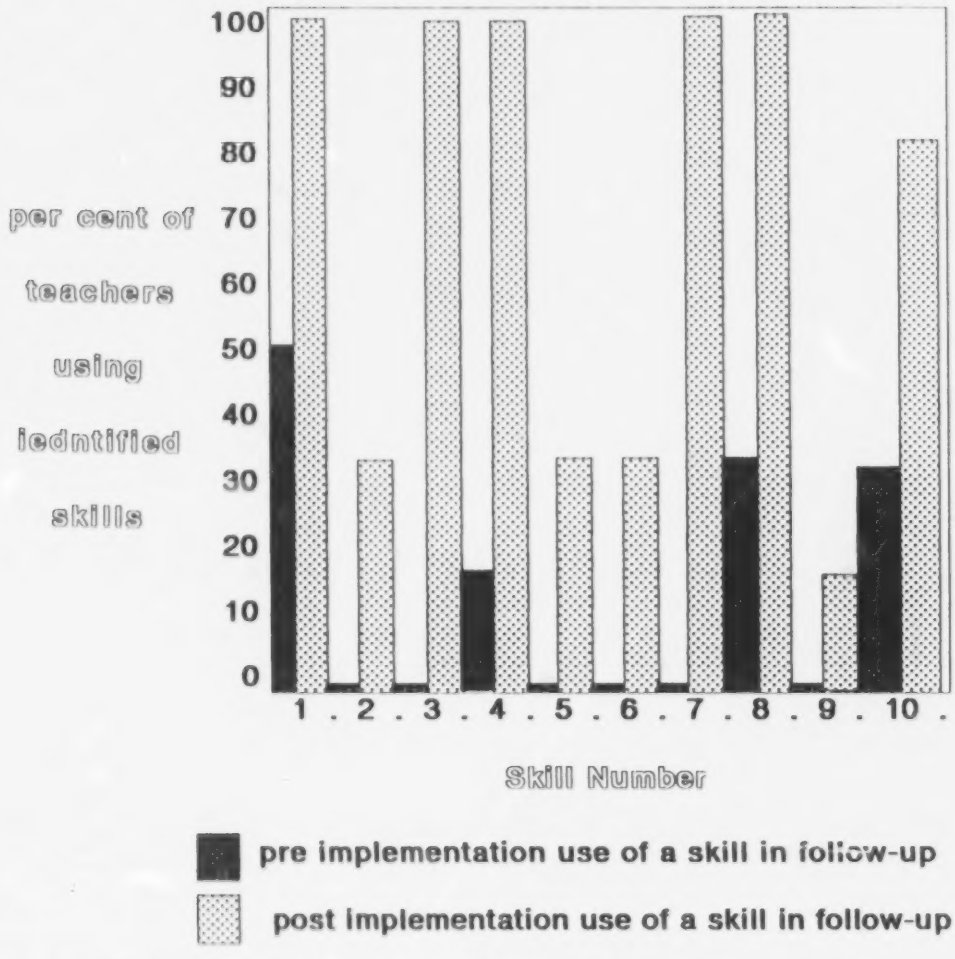
Overall Response 42 / 60 = 70%
Skill Usage

Appendix K (continued)

In-Service Skills Inventory

A comparison of pre and post implementation skill use frequency

This graph indicates the percent of teachers using a specific skill in the follow-up process.



pre implementation use of a skill in follow-up

post implementation use of a skill in follow-up

*** Pre implementation use of the ten identified skills averaged 12%

*** Post implementation use of the ten identified skills averaged 70%

*** An over all increase of 584% in skill use by teachers was calculated.

Appendix L

Comparison of results of the pre- and post administration of the

Teacher Involvement Survey

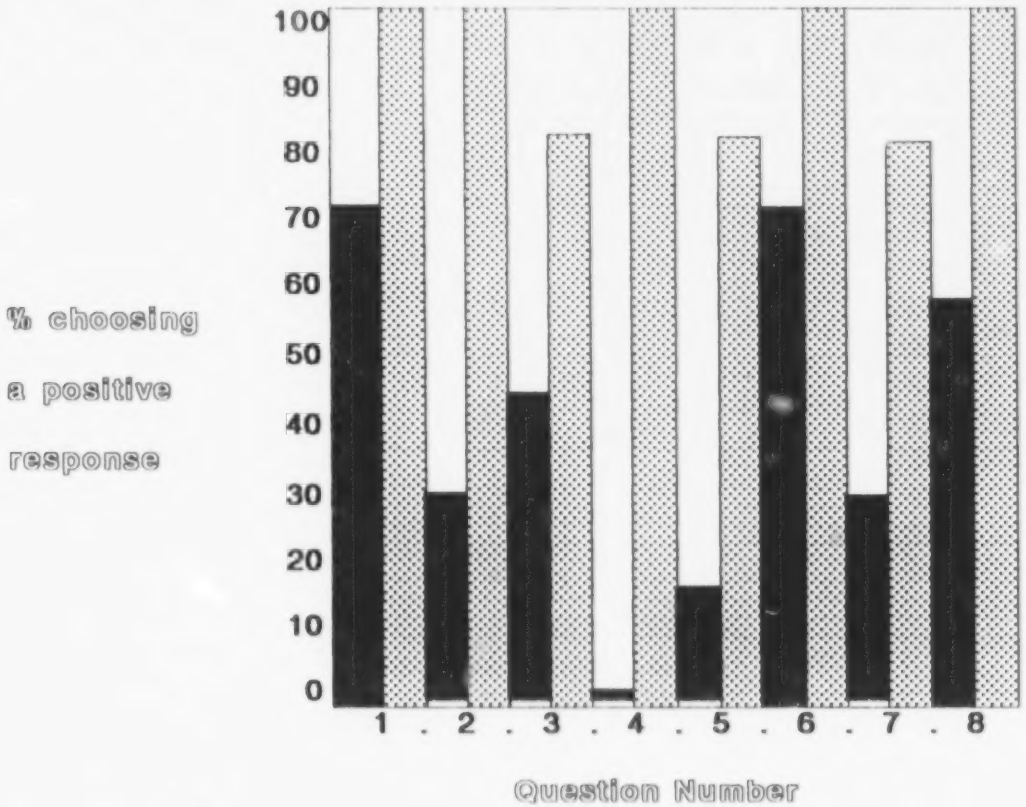
The survey was designed so that choice "A" always represented a positive response and choice "B" always represented the negative response. A break down of the responses is given below.

Pre-Implementation Results				Post-Implementation Results			
Seven teachers				Six teachers			
1.	+ = 5, 71%	/	- = 2, 29%	1.	+ = 6, 100%	/	- = 0, 0%
2.	+ = 2, 29%	/	- = 5, 71%	2.	+ = 6, 100%	/	- = 0, 0%
3.	+ = 3, 43%	/	- = 4, 57%	3.	+ = 5, 83%	/	- = 1, 17%
4.	+ = 0, 0%	/	- = 7, 100%	4.	+ = 6, 100%	/	- = 0, 0%
5.	+ = 1, 14%	/	- = 6, 86%	5.	+ = 5, 83%	/	- = 1, 17%
6.	+ = 5, 71%	/	- = 2, 29%	6.	+ = 6, 100%	/	- = 0, 0%
7.	+ = 2, 29%	/	- = 5, 71%	7.	+ = 5, 83%	/	- = 1, 17%
8.	+ = 4, 57%	/	- = 3, 43%	8.	+ = 6, 100%	/	- = 0, 0%
7 teachers X 8 questions = 56 responses				6 teachers X 8 questions = 48 responses			
* of + responses = 22, total + = 39%				* of + responses = 45, total + = 93%			
* of - responses = 34, total - = 61%				* of - responses = 3, total - = 7%			

Appendix L (continued)
Teacher Involvement Survey

A Comparison of Pre and Post Positive Responses

Positive responses to statements about the Environmental Studies Center program were recorded pre and post practicum implementation. The percentage of positive responses are graphed below.



= Pre - Teacher Involvement Surveys, Positive Response

= Post - Teacher Involvement Surveys, Positive Response

*** Pre implementation an average positive response of 39% was recorded.

*** Post implementation an average positive response of 93% was recorded.

*** An overall increase in positive responses of 239% was calculated.

Appendix M

THE IMPLEMENTATION OF FOLLOW-UP ACTIVITIES TO ENHANCE FIELD EXPERIENCES IN THE MIDDLE SCHOOL

By John Wakeman

The author is currently in the final phases of implementing a practicum through NOVA University, in which teachers are trained to develop and use follow-up activities as a means of enhancing outdoor science investigations in the middle school. Excerpts from the practicum were used in preparing this paper.

For those of us who teach at middle schools, the news that their is a crisis in our system of education is old news. Middle school education has traditionally been conducted against a back drop of rebellion in which students who are more concerned about their social and physical needs question the relevancy of the curriculum. Teachers are challenged to connect the facts they teach to real life situations and practical applications. Currently, programs in the middle schools have a long way to go to make teaching more relevant to the needs and learning styles of students (Lounsburry, 1980).

The depth of this problem is quite severe when considering that middle school students are in a state of rebellion against anything that is not perceived as relevant to a disordered world. In addition, middle school students are impressionable and are forming a list of likes and dislikes that will possibly be carried throughout entire lives (Padilla 1980). It is during the critical middle school years that students may discover subjects in which a life long interest is maintained. Still others lose enthusiasm for some subjects because of the inability to gain a firm foundation in the principles or because little attempt was made to relate the subject matter to experiences and past observations (Griffin 1976). Leary (1990) concluded that students through the 6th grade establish likes and dislikes and that middle school learning should be geared towards natural curiosity.

Appendix M (continued)

Teachers who have become involved in the planning and conducting of a field trip often struggle with the final phase which is follow through. Field trip follow up is the bridge between required school curriculum and real world relevancy. The biggest advantage of a field trip follow-up is the reinforcement brought to concepts taught earlier in class. Teacher conducted follow-up activities are essential for maximum carry over and gaining of knowledge (Holomay 1987).

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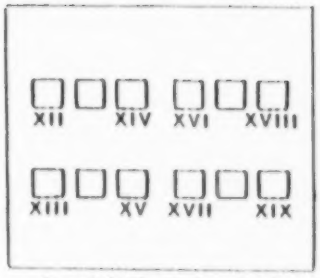
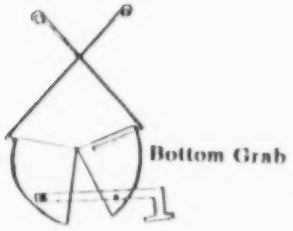
The following are examples of activities which have been used to expand the role of follow-up activities in field experiences. Although the availability of equipment will differ in your own situation, the concept of integrating data collected in the field through the application of practical knowledge in follow-up activities is universal.

Both examples involve the use of the Martin County School's boat *RIVER SCOUT* . The following equipment was used to reinforce oceanography and marine science concepts taught in the classroom...

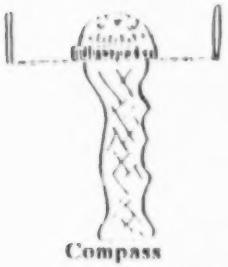
Appendix M (continued)



Forel / Ule Color Scale



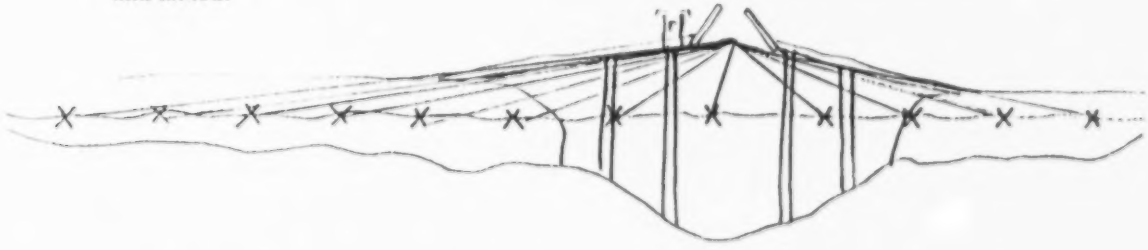
Secchi Disk



Compass

Hydrometer

A class of middle school students who were studying the intraconastal waterway worked as a team to collect data on the depth, salinity, bottom type and plankton composition. The end product would be a student created profile of the intraconastal. Samples were taken at intervals relative to compass sightings made on the draw span as we crossed the waterway. Our position was determined by a team of students responsible for navigation. The data at each of our 12 stations was carefully recorded and samples of plankton and river bottom were collected and labled.



The end product was a profile drawing completed by the students on a piece of butcher paper 10m x 1m. Notations of bottom type, depth, shoreline and plankton were made for each corresponding location.

Appendix M (continued)

A more long term project which involves the collection of data by many classes over a period of years has also been tested. Again the Martin County School's boat *RIVER SCOUT* was used. For 15 years all 6th grade students in the county have spent a day on the *RIVER SCOUT* using the scientific equipment to measure physical and biological conditions of the river systems. Three years ago we began marking the location of each lab station on a large map and saving the data which was collected on an Apple 2e. As a result, students are able to use a data base consisting of nearly 300 work stations which spread across a lagoon, estuary and 2 rivers to complete a follow-up lab activity. Manipulation of the data allows students to identify patterns in water salinity, color, turbidity and bottom composition. Conclusions are drawn based on interpretation of the data.

Teachers who have participated in this program report an increased interest of their students. Students also have a better understanding of the subject resulting from the application of practical knowledge to solve real problems.

Appendix N

INDIAN RIVER LAGOON (IRL)

GRID #	DATE	STA #	SAL (ppt)	TURB	COLOR	B.T
29	Oct 24, 1990	46	25	95	21	M,S,SH,G
32	Oct 24, 1990	47	33	95	19	M,S,CL,
24	Oct 24, 1990	48	34	240	12	M,S,CL
24	Oct 25, 1990	49	21	93	21	S,W,ALGAE
22	Oct 25, 1990	50	30	75	18	S,CL,ALGAE
20	Oct 25, 1990	51	30	105	21	S,M,SH,GR
25	Nov 1, 1990	61	40	180	12	s,sh
20	Nov 1, 1990	62	29	183	18	m,s
21	Mar 18, 1991	79	31	193	16	M,SL,C,W
19	Mar 18, 1991	80	32	209	14	S, M, SH,W,C
24	Mar 19, 1991	82	32	161	17	S/SH/W/G
24	Mar 19, 1991	83	34	150	134	S,R,SH
24	Mar 25, 1991	85	28	140	14	S,C,SH,O
27	Mar 25, 1991	86	31	115	15	S,M,C,SN,W,CR
12	Mar 28, 1991	88	32	105	15	M,SH,CL,W

ST. LUCIE RIVER (SLR)

GRID #	DATE	STA #	SAL (ppt)	TURB	COLOR	B.T
45	Mar 12, 1990	58	26	63	20	M
36	Mar 15, 1990	63	37	55	18	SH M
36	Apr 4, 1990	86	34	115	14	S-SH-C-W
36	Apr 30, 1990	107	37	141	16	SH,S,M
36	Apr 30, 1990	108	36	110	16	S,SI
42	May 4, 1990	114	19	130	20	M,SH
38	Sep 17, 1990	2	31	90	19	M,S,W,C
40	Oct 2, 1990	19	17	65	19	M,C,W,CR
35	Oct 3, 1990	22	24	98	21	si,sn,sn,c
39	Oct 11, 1990	31	27	68	21	S,CL,SH,W
42	Oct 12, 1990	34	14	32	21	st,cl,w
43	Oct 12, 1990	35	12	41	21	sn,cl,sl,si
44	Oct 31, 1990	58	17	156	20	M,S H
41	Nov 5, 1990	64	15	101	18	M,SH
40	Nov 5, 1990	65	18	100	18	SI

SOUTH FORK (SF)

GRID #	DATE	STA #	SAL (ppt)	TURB	COLOR	B.T
50	Apr 24, 1990	100	19	73	20	M,CL,CR
55	Apr 24, 1990	101	4	125	20	M,SI
48	Apr 24, 1990	102	20	75	18	M,S,CL
49	Apr 25, 1990	103	18	57	19	M,SI
49	Apr 25, 1990	103	18	76	20	M, SL, W
52	Sep 25, 1990	15	8	53	20	M,SL
51	Oct 17, 1990	40	5	47	19	M,A,SH
53	Oct 17, 1990	41	5	64	20	S,M,R,A
48	Oct 17, 1990	42	5	45	20	m,sn,sl
48	Oct 30, 1990	57	14	87	21	M,SH,CL
49	Nov 5, 1990	66	12	100	18	M,SI
49	Nov 8, 1990	70	8	52	21	SL, M
50	Nov 8, 1990	71	7	58	21	M,SL
48	Nov 8, 1990	72	16	47	21	SH,N,SL
48	Nov 13, 1990	77	8	60	21	M,SI

NORTH FORK (NF)

GRID #	DATE	STA #	SAL (ppt)	TURB	COLOR	B.T
60	Oct 9, 1989	23	15	61	18	M,SH
56	Apr 10, 1990	91	27	145	17	M,SH
56	Apr 11, 1990	95	24	115	19	M,G,SH
64	Apr 13, 1990	97	22	112	20	M,SH,SL,W
70	Apr 13, 1990	98	15	106	20	M,SL,R,S
66	Apr 13, 1990	99	21	97	19	S,SH
62	Oct 16, 1990	37	5	52	21	M,SL,C,SH
65	Oct 16, 1990	38	5	120	21	M,SH,SL
56	Oct 16, 1990	39	5	45	20	M,SI,O
70	Oct 29, 1990	53	3	75	21	M,SH,SL
65	Oct 29, 1990	54	4	61	21	M,, SH, CL
57	Oct 30, 1990	55	9	74	21	M,SH,SL,C
58	Oct 30, 1990	56	6	63	21	M,SH,SL
62	Oct 31, 1990	59	15	72	17	M, SH
56	Nov 13, 1990	76	8	60	21	M,SI

Appendix N (continued)

6 TH GRADE DATA ANALYSIS

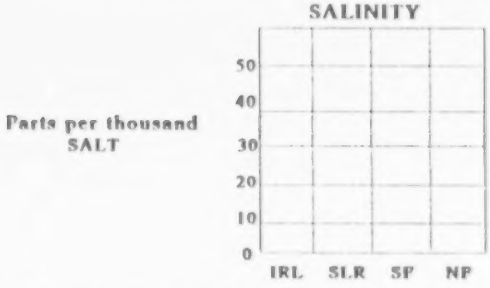
Use the data print out to help you answer the questions on this sheet.

You will need to know the following abbreviations to answer the questions.

IRL = Indian River Lagoon..... grid # 1 - 32
SLR = St. Lucie River..... grid # 32 - 46
SF = South Fork..... grid # 47 - 55
NF = North Fork..... grid # 56 - 72

SALINITY STUDY

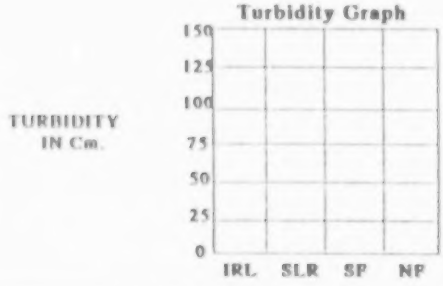
	IRL	SLR	SF	NF
HIGHEST SALINITY				
LOWEST SALINITY				
AVERAGE SALINITY				



Study your salinity graph. Now write a conclusion about your salinity data

TURBIDITY STUDY

	IRL	SLR	SF	NF
HIGHEST TURBIDITY				
LOWEST TURBIDITY				
AVERAGE TURBIDITY				



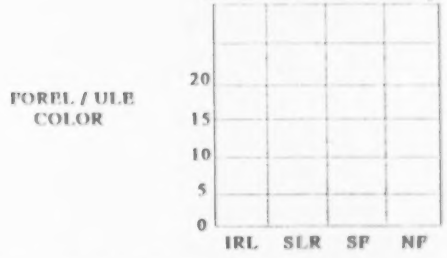
Study your TURBIDITY graph. Now write a conclusion about your data.

Appendix N (continued)

WATER COLOR STUDY

	IRL	SLR	SF	NF
HIGHEST FOREL / ULE COLOR				
LOWEST FOREL / ULE COLOR				
AVERAGE FOREL / ULE COLOR				

Forel / Ule Color Graph



Study your Forel / Ule Color Graph. Now write a conclusion about your data.

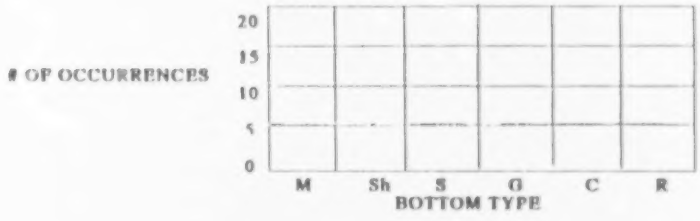
RIVER BOTTOM

Use the data sheet to count up the number of times a bottom type occurred in each section of the river. Record your answers on the chart below.

		IRL	SLR	SF	NF
MUD.....	M				
SHELL.....	Sh				
SAND.....	S				
GRASS.....	G				
CLAM(S).....	C				
ROCKS.....	R				

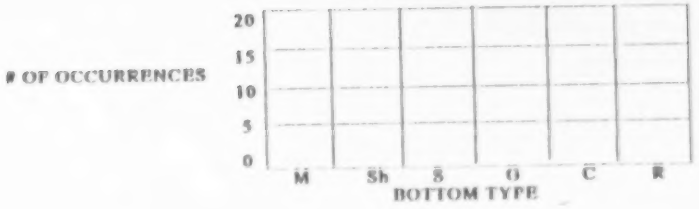
Now use the chart to make a BOTTOM TYPE graph for each section of the river.

Indian River Lagoon (IRL)

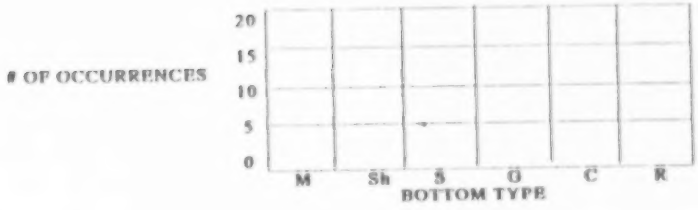


Appendix N (continued)

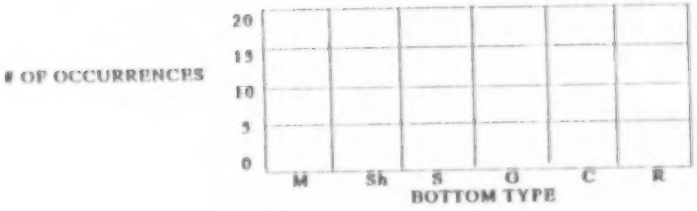
St. Lucie River (SLR)



South Fork (SF)



North Fork (NF)



Appendix N (continued)

6th GRADE TEST

EQUIPMENT IDENTIFICATION

A video tape will be played which shows 10 pieces of boat equipment in use. You will have about 30 seconds to identify and then match the equipment to the choices given below.

Questions # 1 -- 10 CHOICES:

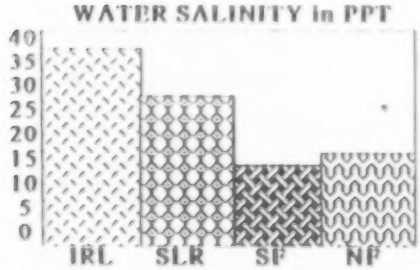
A) Anemometer
B) Bottom Grab
C) Water Sampler
D) Parallel Ruler
E) Secchi Disk
F) Hydrometer
G) Binoculars
H) Psychrometer
I) Plankton Net
J) Depth Sounder
K) Thermometer
L) Compass
M) Forel / Ule Color Scale
N) Dissolved Oxygen
O) Barometer
P) Meter Stick

DATA INTERPRETATION

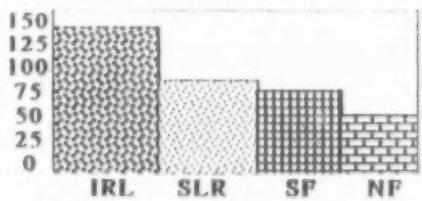
Use the data from the following graphs to answer the test questions. The following abbreviations were used...

IRL = Indian River Lagoon
SLR = St. Lucie River
SF = South Fork
NF = North Fork

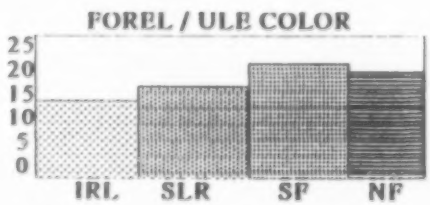
WATER SALINITY in PPT



TURBIDITY IN Cm.



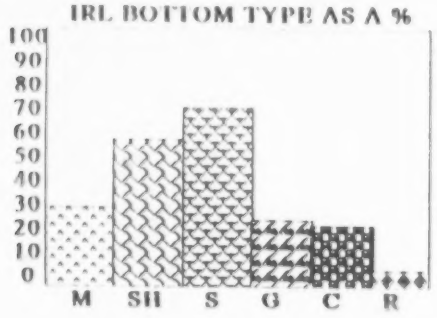
FOREL / ULE COLOR

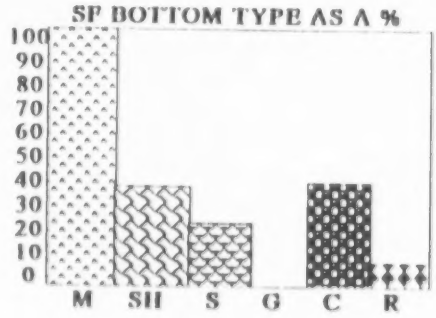


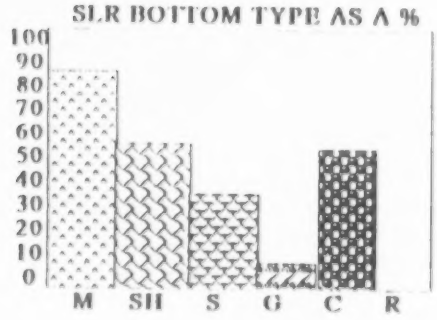
Appendix N (continued)

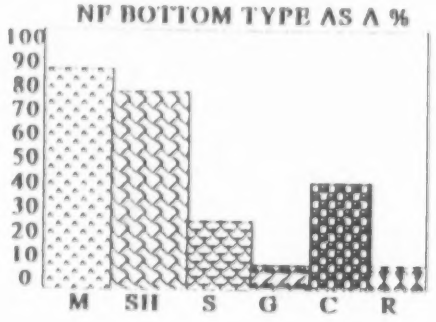
The following abbreviations were used for river bottom type...

M = MUD, SH = SHELL, S = SAND, G = GRASS, C = CLAM, R = ROCK









CHOICES FOR QUESTIONS # 11 - 20.....

A) IRL B) SLR C)SF D) NF

11. Which section of river is most turbid?
12. Which section of river has the least amount of salt in the water?
13. Which section of river has the darkest color?
14. Which section of river has the most mud on the bottom?
15. Which section of river is the least turbid?
16. Which section of river has the most amount of sand on the bottom?
17. Which section of river will you least likely find grass on the bottom?
18. Which section of river has the most amount of salt in the water?
19. Which section of river has the least amount of mud on the bottom?
20. Which section of river is least turbid?

Appendix N (continued)

PHYSICAL INTERRELATIONSHIPS

21. During a 24 hour period of time, the water in the St. Lucie River becomes saltier, fresher and saltier again. What causes these changes?

A) tides
B) depth
C) wind
D) mud

22. What type of river bottom is usually found in areas of strong currents?

A) mud
B) algae
C) sand
D) grass

23. The RED and BLACK mangroves are found in what type of river bottom?

A) sand
B) mud
C) grass
D) shells

24. Each year the water in the Indian River Lagoon is fresher in the summer and saltier in the winter. This change is caused by...

A) mangrove development
B) rainfall
C) fast currents
D) muddy bottom

25. Which will have the *MOST* influence on the turbidity of the rivers?

A) temperature
B) time of day
C) tides
D) salinity

26. Mangrove trees develop in the tropic temperatures on shallow banks of the St. Lucie and Indian River Lagoon. Which of the following physical factors is also necessary for mangroves to grow?

A) currents
B) algae
C) salt water
D) sand

27. Sandy areas, tropical temperature and salt water are physical factors that influence the development of manatee and turtle grass in the Indian River Lagoon. What other physical factor is also necessary?

A) shallow water
B) sandy bottom
C) fish
D) turbid water

28. Seasons, tides and water depth influence the temperature of the rivers. Which of the following physical factors is also an influence on temperature?

A) algae
B) sandy bottom
C) salinity
D) sun

Appendix N (continued)

29. Which factor will most likely cause the salinity of the St. Lucie River to become lower?

A) turbid water
B) removal of mangroves
C) algae bloom
D) opening of spillways at the St. Lucie Locks and Dam

30. What season of the year is the salinity of the rivers the lowest?

A) winter
B) spring
C) summer
D) fall

ENVIRONMENTAL PROBLEMS

31. Canals and gates were constructed from Lake Okeechobee to the ocean...

A) to irrigate citrus groves
B) to prevent disastrous flooding
C) to increase bird population
D) to prevent a fish kill

32. What factor could be a cause of pollution in the Indian and St. Lucie Rivers?

A) tides
B) decrease in pelicans
C) too many grassflats
D) too many people

33. Which factor could destroy mangroves along the St. Lucie and Indian River Lagoon?

A) too much fresh water
B) high tides
C) tropical climate
D) build-up of detritus

34. What could destroy the Indian River Lagoon grassflat nurseries?

A) tides
B) seasons
C) fresh water
D) 50 mph winds

35. What is the main reason that the nuclear power plant was built on Hutchinson Island?

A) favorable climate
B) good location
C) jobs for people
D) increased population and power usage

36. When the spillways at the St. Lucie Dam are opened to lower the depth of Lake Okeechobee, the salinity of our rivers is also lowered. What could be the effect on organisms in the rivers?

A) no effect
B) kill many organisms
C) cause a high tide
D) more organisms due to less salt

Appendix N (continued)

37. The water used to cool the nuclear power plant on Hutchinson Island is discharged into the ocean. One change this may cause is...

A) cooler water
B) no change
C) change in plants and animals in the discharge area
D) tidal changes

38. Florida has a law that prevents the removal of RED mangroves because...

A) the government likes mangroves
B) the mangrove is the state tree
C) developers use them as landscape trees
D) removing mangroves may cause erosion

39. Grassflat destruction by dredge and fill in the Indian River Lagoon will...

A) help clean the river
B) increase the fish population
C) destroy game fishing
D) do no harm

40. You can not eat oysters and clams from the Indian River Lagoon in Martin County because...

A) the water is polluted
B) the water is too fresh
C) birds eat them all
D) the water is too salty

VOCABULARY

41. Which two instruments are needed to calculate salinity?

A) sea test - thermometer
B) secchi - anemometer
C) seine - sieve
D) sighting compass - bottom grab

42. Which is a unit of *length*?

A) data
B) meter
C) seine
D) gram

43. Which of the following is an *organism*?

A) fish bone
B) crab
C) an empty sea shell
D) rock

44. What tree grows in the *brackish* waters along our waterways?

A) oaks
B) seagrapes
C) cypress
D) mangroves

Appendix N (continued)

45. What is a piece of equipment used to collect microscopic organisms from the water?

A) water sampler
B) plankton net
C) refractometer
D) secchi disk

46. What is a side view of something called?

A) profile
B) data
C) sighting compass
D) sample

47. While on the *RIVER SCOUT* you collected information on temperature, bottom type and salinity. What is this information called?

A) graphs
B) data
C) sieves
D) charts

48. What is the cloudiness of the water called?

A) salinity
B) current
C) lagoon
D) turbidity

49. What controls the kind of plants and animals found in the St. Lucie River and Indian River Lagoon?

A) organisms
B) physical factors
C) shrimp
D) mangroves

50. What is the term for a body of water separated from the ocean by a barrier island. An example of such a body of water is the Indian River.

A) lake
B) pond
C) lagoon
D) estuary